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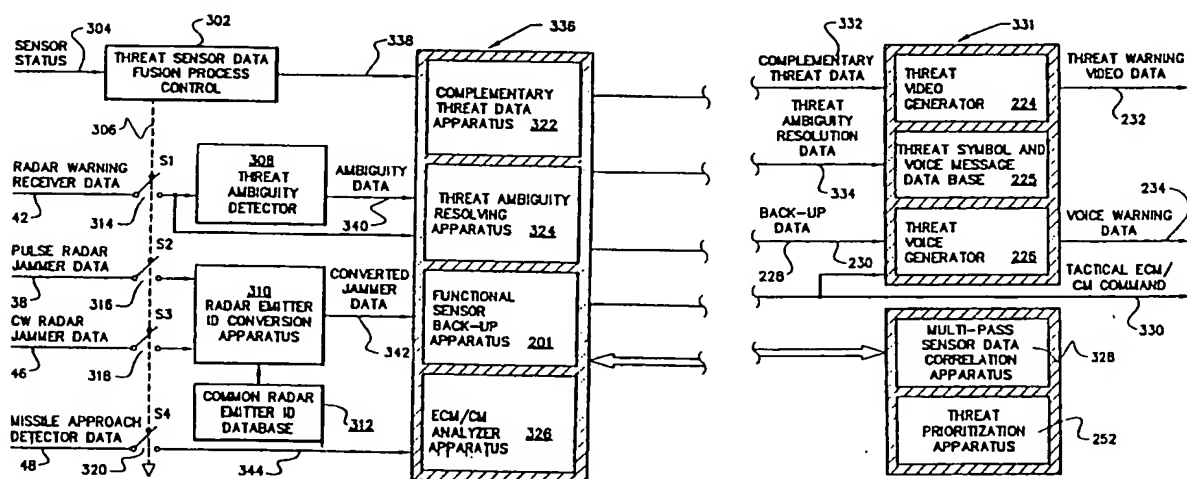
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(54) Title: COMPLEMENTARY THREAT SENSOR DATA FUSION METHOD AND APPARATUS



(57) Abstract

A complementary threat sensor data fusion capability for an aircraft survivability equipment system (10). A set of aircraft survivability sensors (12, 32, 34, 36) provides a threat sensor data fusion control process (302) with status data (304). The control process controls (302) whether or not a threat ambiguity detector (308) receives radar warning receiver data (42) or a radar emitter ID conversion apparatus (310) receives pulsed radar jammer data (38) or continuous wave radar jammer data (46). The threat sensor data fusion control process (302) also determines whether missile approach detector data (48) is sent to a countermeasures analyzing apparatus (326). The threat ambiguity detector (308) provides ambiguity data (340) to a threat ambiguity resolving apparatus (324). The radar emitter ID conversion apparatus (310) provides converted jammer data (342) to a functional sensor back-up apparatus (201). The radar emitter ID conversion process (310) receives a common radar emitter (ID) data base (312). The threat sensor data fusion process controller (302) also provides fusion process control (338) to the complementary threat data apparatus (322). Complementary threat data (332) is provided to the pilot through various presentation methods and to the jammers (34, 36) for electronic countermeasures. Also, threat ambiguity resolution data (334) is provided and back-up data (228, 230) is provided. The presentation methods include video (224) and voice (226) and a tactical electronics countermeasures command (330) is automatically initiated. A multi-pass sensor data correlation algorithm (328) and a threat prioritization algorithm (252) share information with the threat ambiguity resolving algorithm (324), complementary threat data algorithm (322), functional sensor back-up apparatus (201), and electronic countermeasures apparatus (326). The direction of jamming is determined by data correlation between the radar warning receiver (12) and the CW Jammer (34).

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COMPLEMENTARY THREAT SENSOR DATA FUSION METHOD AND APPARATUS

United States Government Rights

5 The United States Government has acquired certain rights in this invention through government Contract No. DAA B07-87-C-H041 awarded by the Department of the Army.

BACKGROUND OF THE INVENTION

Field of the Invention

10 The invention relates to an aircraft survivability system, and more particularly to a complementary threat sensor data fusion method and apparatus.

Discussion of the Prior Art

15 In the prior art, individual aircraft survivability equipment (ASE) sensors are used as stand-alone systems. The use of such systems in a stand-alone manner results in high pilot workloads. Further, in such systems only a limited amount of threat data is presented to the pilot. Data provided by various ASE subsystems such as pulsed radar jammers, continuous wave (CW) radar jammers and missile approach detectors have previously not been used to provide a comprehensive and coherent picture of the threat environment. Thus prior art systems often do not present adequate data in a readily understood format to enable the pilot to quickly and completely assess a given threat environment.

20 Prior art sensors standing alone in electronics warfare sensor systems suffer a number of drawbacks. Because they are stand alone, the quality of threat identification is not as good as it would be if the sensors were integrated as disclosed in the present invention. The overall threat detection and ability to counter RF guided missiles and to prevent threats is degraded by the stand alone nature of prior art electronic warfare systems. Therefore it is the motivation of the invention to overcome the inherent performance limitations of stand alone electronic warfare sensors by providing a complementary threat sensor data fusion method and apparatus.

SUMMARY OF THE INVENTION

30 The invention provides a complementary threat sensor data fusion capability for an aircraft survivability system. A set of aircraft survivability sensors provide a threat sensor data fusion control process with status data. The control process controls whether or not a threat ambiguity detector receives radar warning receiver data or a radar emitter ID conversion apparatus receives pulsed radar jammer data or continuous wave radar jammer data. The threat sensor data fusion control process also determines whether missile approach detector data is sent to a countermeasures analyzing apparatus. The threat ambiguity detector provides ambiguity data to a threat ambiguity resolving apparatus. The radar emitter ID conversion apparatus provides converted

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jammer data to the core functions of the complementary threat sensor fusion apparatus. These core functions include a complementary threat data apparatus, a threat ambiguity resolving apparatus and functional sensor back-up apparatus. The radar emitter ID conversion process receives a common radar emitter ID data base. The threat sensor data fusion process controller also provides fusion process control signal to activate the following apparatus: complementary threat data, threat ambiguity resolving, functional sensor back-up and electronic countermeasures analyzer. Complementary threat data is provided to the pilot through various presentation methods. Also, threat ambiguity resolution data and back-up data is provided. The presentation methods include video and voice. A tactical electronics countermeasures command is automatically initiated. A multi-pass sensor data correlation apparatus and a threat prioritization apparatus shares information with the threat ambiguity resolving apparatus, complementary threat data apparatus, functional sensor back-up apparatus, and electronic countermeasures apparatus.

The invention uses threat data blending concepts to provide these unique capabilities: a) to correctly detect and identify threat weapon systems, b) to coherently combine different sensor data for total threat presentation, c) to provide functional sensor back-up, d) to analyze and queue electronics countermeasures (ECM) information to jammers, and e) to provide automatic RF countermeasures (CM) dispensing.

Other objects, features and advantages of the present invention will become apparent to those skilled in the art through the description of the preferred embodiment, claims and drawings herein where like numerals refer to like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a high level system diagram of one embodiment of the aircraft survivability integration equipment system as employed by the invention.

Figure 2 shows a more detailed block diagram of the aircraft survivability equipment integration system 10 which is integrated into an aircraft survivability equipment/avionics control system (ASE/ACS).

Figure 3 shows a method of the invention that is used to convert the current actual threat data, that is sent to the system bus from either the continuous wave radar jammer or the pulsed radar jammer, to either an un-correlated threat or an identified threat.

Figure 4 shows one method of the invention used to perform data correlation on radar warning receiver data.

Figure 5 shows a data flow diagram showing the various data sets of the invention in a Venn diagram fashion.

Figure 6 shows a schematic block diagram for the functional radar warning